

2008 WMA Mini-Grant Research Project Proposal

Contract Lead Group and Contact Person(s) (name, phone number, email, and address):

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This project is in affiliation with what WMA group or groups?

Humboldt- Del Norte WMA

List what other Noxious and Invasive Weed Research has been conducted by you or your group:

Mechanical eradication methodologies for *Spartina densiflora* (Conducted by HBNWR with funding from Coastal Conservancy)
Mechanical Control of *Ammophila arenaria*, *Carpobrotus chilense*
Flaming, mowing, and digging of invasive annual grasses
Invasion ecology and manual control of *Lupinus arboreus*
Invasion ecology of *Parentucellia viscosa*

Proposed Project(s)

Project Title: Effect of invasive *Spartina densiflora* and its removal on macroinvertebrate communities.

Project Goal (1/2 page max):

The goal of this project is to help determine the ecological role and environmental impacts of invasive dense-flowered cordgrass (*Spartina densiflora*) in the Humboldt Bay region by comparing the macroinvertebrate species associated with salt marsh dominated by *S. densiflora* with those species associated with salt marsh dominated by native plant species. This research project will inform the development of a regional invasive cordgrass eradication plan for the Humboldt Bay, Eel River, and Mad River estuaries. The goal of the plan is to restore and protect the native plant and wildlife communities of tidal marshes in these three estuaries. Invasive dense-flowered cordgrass has invaded an estimated 90% of salt marshes in the three adjacent estuaries of Humboldt Bay, the Eel River Delta, and the Mad River Estuary. *S. densiflora* is known to displace native vegetation, reducing the biodiversity of the salt marsh dramatically. The species was mapped in Humboldt Bay in 1998 and 1999. At that time, over half of the total salt marsh consisted of nearly pure stands of invasive cordgrass, and the species was present in much of the remaining salt marsh, as well. While invasive cordgrass is most abundant at mid-marsh elevations in Humboldt Bay, it has been shown to be spreading to the high marsh, where it threatens to displace populations of Humboldt Bay Owl's Clover (*Castilleja ambigua* ssp. *humboldtiensis*) and Point Reyes Bird's Beak (*Cordylanthus maritimus* ssp. *palustris*), both ranked as endangered (List 1B.2) by the California Native Plant Society. Whereas *S. densiflora* is the only species of *Spartina* currently known in Humboldt County, other west coast estuaries that have been studied and/or managed have been invaded primarily by *S. alterniflora*. This species occupies a very different ecological niche and its role and impacts in the estuary cannot be generalized to *S. densiflora*.

What are the project's long-term benefits and/or local, regional or statewide significance (8 sentence Max):

The project will inform the development of a Regional *Spartina* Eradication Plan by helping to identify the ecological role and environmental impacts of *S. densiflora*. The project will facilitate the restoration of native vegetation in Humboldt Bay, Eel River and Mad River Estuary, plant and wildlife habitat of regional and statewide importance for resident and migratory

species. In addition, the project will facilitate the protection of marshes in Oregon and Washington from colonization by invasive *Spartina* seeds dispersing from the Humboldt Bay region. In addition to its direct impacts, the dominance of invasive cordgrass in Humboldt Bay has slowed efforts at marsh restoration because of fears that restored marshes will become dominated by cordgrass, compromising their habitat value. The 2007 West Coast Governors' Agreement on Ocean Health Draft Action Plan calls for the west coast-wide eradication of invasive *Spartina* cordgrasses.

Priority Topic Area Being Addressed (from request for proposal announcement, 8 sentence Max):

The project addresses priority topic #4 (Wildlife and Invasive Plant Interactions). By comparing the macroinvertebrate community associated with salt marshes dominated by *S.densiflora* with those dominated by native plant species, the study will help quantify impacts of this invasive species on the invertebrate community. By quantifying changes to the macroinvertebrate community following *S.densiflora* eradication, this study will identify environmental benefits and/or costs of eradication.

Please Describe your in-kind contributions toward research project(s) (4 sentence max):

In kind contributions will include HBNWR staff time to manage the study and to assist in preparation of the report and dissemination of results, the use of HBNWR facilities to house participating researchers, and Coastal Conservancy staff time for project management. The project will also benefit from the in-kind contribution of Dr. Alejandro Bortolus, an expert on *Spartina densiflora*-invertebrate interactions from the National Patagonian Center in Chile, who has agreed to assist with study design, refinement of methodology, and data analysis.

Project Objectives, Tasks and Methods:

OVERALL OBJECTIVE (4 sentence Max):

The objective of this study will be to determine the effect of *Spartina* dominance of salt marshes on the macroinvertebrate community and to determine the effect of *Spartina* eradication on the salt marsh macroinvertebrate community. This study will involve sampling and identifying benthic, epibenthic, and epiphytic invertebrates. This study will compare invertebrate communities in areas where cordgrass has been eradicated with control sites, and follow the invertebrate community as native marsh vegetation is restored to the area.

Task 1 (2 sentence Max): Compare macroinvertebrate community in salt marsh dominated by *Spartina* and salt marsh dominated by native plant species

Methods (8 sentence Max)- Ten intertidal sites in Humboldt Bay (5 in marsh with >70% cover of *Spartina* in the 2-m-radius circular area surrounding the sample site, 5 in marsh with <10% cover native *Spartina* and >70% cover native plant species in the 2-m-radius circular area surrounding the sample site) with similar elevations and soil types will be visited at low tides for sampling. Fauna samples will be stratified in order to separate infauna from epifauna (including the epiphytic). At each of the five sites, 5 core samples (approx. 20 cm in diameter and 15 cm in depth) randomly placed within the 2-m radius circular area will be collected and passed through a 0.5 mm stainless steel screen. All organisms retained on the screens will be sorted under a microscope (60 x) for identification at the lowest taxonomic level possible, fixed in formalin (4%) for 24 hours and then preserved in ethanol (70%). Plant height, stem density and/or percent relative cover of all plant species present in the 2-m-radius area surrounding each sample centerpoint will be estimated. Aboveground plant structures will be clipped at surface level and all faunal organisms will be separated under a microscope (60x) for identification as described above. Plant material from each sample will be labeled and then oven-dried at 70°C until the samples reach a constant weight in order to estimate the standing crop biomass associated with each invertebrate sample.

Task 2 (2 sentence Max): Compare salt marsh macroinvertebrate community before and after *Spartina* eradication.

Methods (8 sentence Max)- Macroinvertebrates will be collected from benthic and vegetation samples from a *Spartina* eradication site and compared with the *Spartina* and native sites above. Samples will be collected from a marsh that has been undergoing control for 2 years. Samples will be located in areas in which native plants have recovered to greater than 70% (after denudation), and areas in which native cover is still less than 25%. Samples will therefore represent points along the recovery gradient. Plant height, stem density and/or relative cover of all plant species present in the 2-m-radius area surrounding each sample point will be estimated.

Performance Measures:

How will you assess and/or analyze your results (8 sentence Max)?

We will use 2-way ANOVA to test the hypothesis that macroinvertebrate density and taxonomic richness varies by vegetation type and by treatment (*Spartina* eradication). We will compare invertebrate taxonomic diversity (Simpson's Index and Shannon Index) and test the hypothesis that these indices differ between vegetation types and treatments, using randomization tests (e.g. jackknifing test). We will use principal components analysis (PCA) to extract principal

components from relative abundance measures, and use 2-way multivariate analysis of variance to test for differences in these principal components, in order to test the hypothesis that community composition varies between vegetation types and treatments.

How will your results be disseminated (4 sentence Max)?

Results will be summarized in a technical report and in the *Spartina* Eradication Plan for the Humboldt Bay region. Results will be used, along with the results of other technical studies, in literature and presentations to the public regarding *Spartina*, its role in the Humboldt Bay ecosystem, and the costs and benefits of eradicating it. Results will also be presented at the Humboldt Bay Symposium, regional conferences, and in a peer-reviewed publication.